Network Centric Warfare:

Real Advantages or Science Fiction?

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INTRODUCTION

To become a more responsive and dominant combat force, the United States (U.S.) Army is changing its strategy from bigger and stronger weapons to faster and more agile ones. The Future Combat Systems (FCS) – which the Army calls the "greatest technology and integration challenge ever undertaken" – is expected to meet the Army's transformational objectives.[1] Forming FCS' backbone is, Network Centric Warfare (NCW), an information network that links eighteen systems. At a fundamental level, the FCS concept is replacing mass information with superior information; that is, to see and hit the enemy first, rather than to rely on heavy armor. Referring to NCW, Secretary of Defense Donald H. Rumsfeld has said, "Possibly the single most transforming thing in our force will not be a weapons system, but a set of interconnections and a substantially enhanced capability because of that awareness."[2] This sentiment may be evidenced by Congress' approval of the Pentagon's plans to spend well over $1 trillion over the next decade on the arsenal of futuristic planes, ships, and other systems, including NCW.[3] This paper will attempt to examine NCW, and determine whether it is worth further pursuing by the U.S. government. Specifically, it will study NCW by discussing: 1) the background and the workings; 2) the potential uses and advantages for the U.S. military; 3) possible vulnerabilities and disadvantages; and 4) a recommendation for the best policy for the Department of Defense (DoD) to pursue.

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[1] The transformational objective to overhaul the U.S. Armed Forces has been a key goal of Secretary of Defense Donald Rumsfeld well before the attacks of September 11, 2001. Paul L. Francis, "The Army's Future Combat Systems' Features, Risks, and Alternatives," *Testimony Before the Subcommittee on Tactical Air and Land Forces, Committee on Armed Services, House of Representatives*, United States General Accounting Office (GAO), April 1, 2004, source no. GAO-04-635T, available at: http://www.gao.gov/cgi-bin/getrpt?GAO-04-635T.

[2] "DOD Launches Quantum Leap-1," *News Release*, United States Department of Defense (DoD), August 28, 2003, No. 627-03, available at: http://www.defenselink.mil/releases/2003/nr20030828-0413.html.

[3] Dan Morgan, "Congress Backs Pentagon Budget Heavy on Future Weapons," *Washington Post*, June 11, 2004, available at: http://www.washingtonpost.com/wp-dyn/articles/A32689-2004Jun10.html.

BACKGROUND

NCW represents a powerful set of warfighting concepts and military capabilities that allow warfighters to take full advantage of all available information and bring all available assets to bear in a rapid and flexible manner. The tenets of NCW are: 1) a networked force improves information sharing; 2) information sharing boosts the quality of information and shared situational awareness; 3) shared situational awareness can enable collaboration and self-synchronization, which improves sustainability and speed of command; and 4) all of these, in turn, drastically increase mission effectiveness.[4] The term "networking" can be thought of as an interconnection of a system of computers, communications, data applications, people, training, and other support structures that provide rapidly and intelligently (i.e. timely and without overload) information processing needs.[5] In NCW, networking consists of the network (connectivity between nodes [or points]) and net-ready nodes (forces capable of sharing information and collaborating). Thus, networking refers to the degree of interconnection among units of action, where networking depends on the nodes of the network and nodes are the units of action capable of sharing information and collaborating. The Pentagon's plans for the first FCS increment will be comprised of an information network and eighteen various systems – manned ground systems, unmanned ground systems, and unmanned air vehicles. While some systems will play a larger role in the network than others, the network will reside in all systems, providing information as well as taking information. The communications backbone for NCW will be a multi-layered mobile network centered on the Joint Tactical Radio System, which

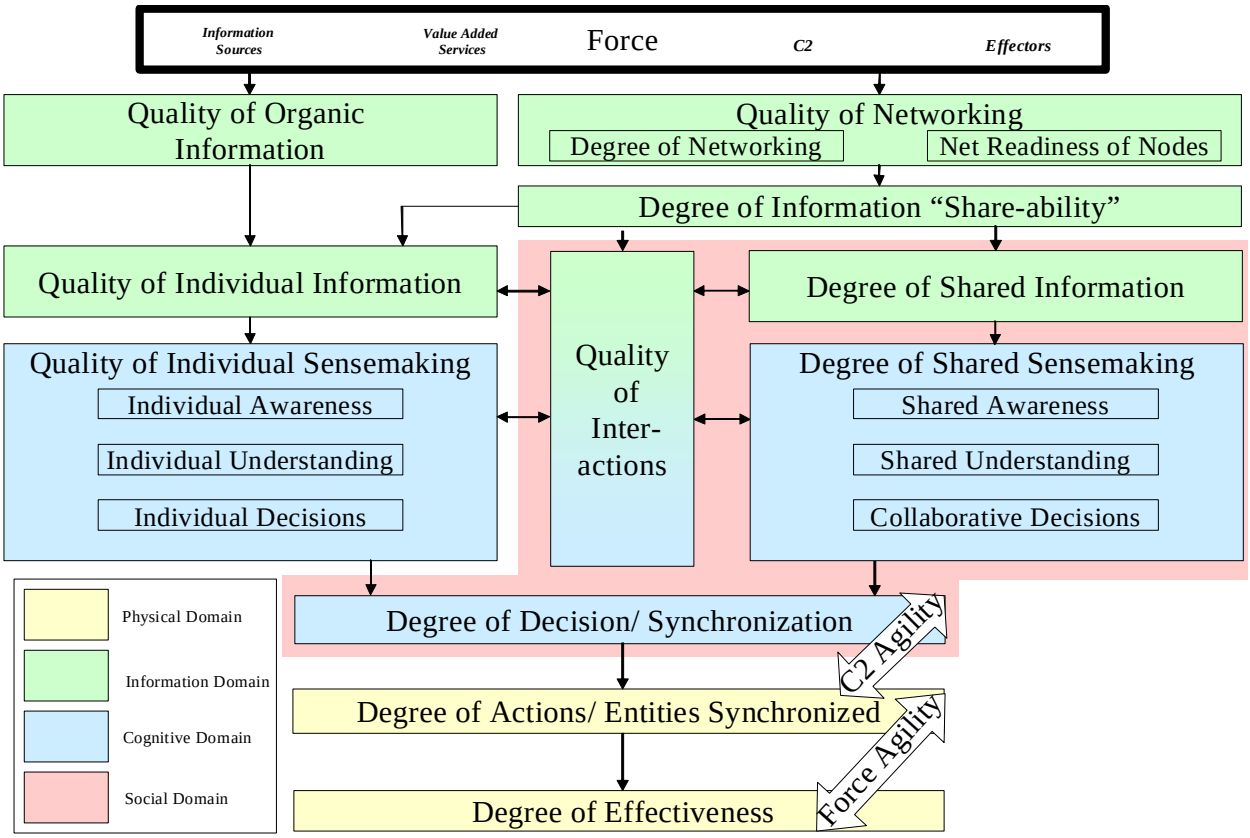
[4] "Network Centric Warfare," *Report to Congress*, Command and Control Research Program (CCRP), Networks and Information Integration (NII), Department of Defense (DoD), July 27, 2001, p. 3-1, available at: http://www.dodccrp.org/research/ncw/ncw_report/flash.htm.
[5] Ibid.; Webopedia definition, www.webopedia.com/TERM/I/network.html.

consists of a family of software programmable radios providing multi-channel voice, data, imagery and video communications without the problems caused by the "stovepipe" legacy systems.[6] All soldiers and FCS vehicles in the theater, including unmanned vehicles, will employ these systems.

Networking involves more than the physical communication links between people and information systems they use, and information systems must produce information that is cohesive and flexible. There are three types of information: organic, individual, and shared.[7] Organic information is "derived" from the units of action, and the information is not shared and is unavailable to the network. Individual information, the first type of non-organic information, refers to all information available to a unit. Shared information is information that is gathered from the network and has also to do with the concept of extent. The latter is unique because it must factor both the quality and the extent to which information is shared, while only the quality of information is assessed for individual and organic information.[8] Together, networking and information form the core of NCW. The degrees to which units of action are networked (quality of networking) along with their ability to rapidly and intelligently share information (quality and degree of information sharing) and utilize their organic information are crucial in determining the overall effectiveness of FCS. Figure 1 shows the conceptual framework of NCW as imagined by the planners.

Figure 1: NCW Conceptual Framework[9]

[6] "Technical Overview," The Joint Tactical Radio System Program, available at: http://jtrs.army.mil/index.htm.
[7] David S. Alberts & Richard E. Hayes, "Power to the Edge: command, control in the information age," Washington, D.C., CCRP Publications, 2003, available at: http://www.dodccrp.org/publications/pdf/Alberts_Power.pdf.
[8] "Network Centric Operations Conceptual Framework Version 1.0," Evidence Based Research, Inc., November 2003, p. 31, available at: http://www.iwar.org.uk/rma/resources/ncw/ncw-conceptual-framework.htm.
[9] "Network Centric Operations Conceptual Framework Version 1.0," p. 27.



POTENTIAL ADVANTAGES

NCW is an approach to warfare, which focuses on the greater synergistic effect that can be created by networking, and electronically linking geographically separated forces into one sensor-to-shooter engagement grid.[10] A common theory on warfighting, which has been tested and supported in several studies, states that power is increasingly derived from information sharing, information access, and speed of information processing.[11] As a result, some military advantages of NCW operations include the following:

[10] The engagement grid may be defined as the shared area of the intelligence, surveillance, and reconnaissance sensor grid and the weapons reach envelope.

[11] For two extensive studies on this, see John Garstka, "Network-Centric Warfare Offers Warfighting Advantage: datalinks are the new weapon of the information age," Signal Forum, *Signal Magazine*, May 2003, available at:

1) Networked forces of smaller size that are lighter, smarter, and faster can perform a mission effectively at a lower cost. This also means fewer troops with fewer platforms carrying fewer supplies, which ultimately denotes fewer resources – both "blood and treasure."

2) Networked forces can employ new tactics such as "swarm tactics." Due to shared-situational awareness and self-synchronization, movements need not be in a tight formation but can move quickly, without securing the rear. The benefits of "swarming" may include: 1) fewer troops and less equipment are needed; 2) spread out combat units can cover greater ground; 3) spread out troops are harder for an enemy to effectively attack; 4) shared-situational awareness reduces fratricide;[12] and 5) a swarming tactic allows an attack to be directed at key strategic points, with the element of surprise. Greg Gagnon describes this event of achieving surprise through speed – increasing the speed of the observe-orient-decide-act (OODA) loop while delaying the time it takes for the enemy to complete their own OODA cycle – as sustaining relative superiority.[13]

3) The way in which individual soldiers think in the battlefield changes. When faced with problems, troops can communicate with support personnel in the Tactical Operations Center – as far as the Pentagon – who can "swarm" the problem and provide feedback.

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http://www.us.net/signal/Archive/May03/networkcentric-may.html; William H. McRaven, "Special Operations – Case Studies in Special Operations Warfare: theory and practice," Novato, CA: Presidio, 1995.

[12] For our purposes, the term "fratricide" here refers only to friendly fire casualties during combat operations.

[13] Capt. Greg Gagnon (USAF), "Network-Centric Special Operations: exploring new operational paradigms," *Air & Space Power Chronicles*, Information Warfare Site, February 4, 2002, available at: http://www.iwar.org.uk/rma/resources/ncw-specialops/gagnon.htm.

4) The sensor-to-shooter time period is reduced. Forces in the theater of operation have the capability to perform "on site analysis" of raw intelligence and other information, rather than wait for return analysis reports from commanders.

NCW is a concept focused on transforming greater situational awareness into increased operational tempo by decreasing the period of ones own OODA cycle – this speed of command is the essence of turning network centric operations into combat power.

POSSIBLE DISADVANTAGES

Some observers have argued that networking for information exchange is not a sufficient substitute for combat maneuver, and that information superiority and situational awareness are not as significant for combat. They argue that discussions of military transformation have overwhelmingly focused on the rewards of information, and that the proponents have not thoroughly studied the risks of data-dependent military doctrine.[14] Some of the key concerns of these critics include the following:

1) Some experts are weary of the "technological boom" and wonder whether the proponents are making exaggerated or overstated claims. They believe that the DoD model may underestimate an enemy's ability to deceive sensors or counter NCW, partly due to the fact that DoD has openly published plans for using NCW technologies in the future.

[14] Michael Schrage, "Perfect Information and Perverse Incentives: costs and consequences of transformation and transparency," Security Studies Program Working Paper, Massachusetts Institute of Technology (MIT), May 2003, p. 15, available at: http://ebusiness.mit.edu/schrage/Articles/ssp-workingpaper.pdf.

2) Whether the U.S. military forces can achieve true network and systems interoperability among all services is questioned. An example is the Global Command and Control System (GCCS), which runs under sixteen different databases, with multiple frameworks for different military branches and divisions.[15]

3) Some observers question whether communications bandwidth supply can be made adequate to match the growing military needs. Military personnel have been forced to subjectively prioritize the transmission of messages, and, according to former Assistant Secretary of Defense for Networks and Information integration (ASD/NII), Paul Stenbit, the primary barrier to NCW is meeting the demand for bandwidth.[16]

4) The U.S. armed forces are highly dependent on space assets for communications, navigation, imagery, weather analysis, and more. While the U.S. has enjoyed space dominance thus far, it cannot be guaranteed in the future. An enemy can employ jamming techniques, disrupt ground facilities, or lease satellite bandwidth.

5) Outsourcing of high tech jobs, such as computer programming and chip manufacturing, may threaten U.S. technical superiority and undermine the potential NCW advantages. One study has reported that corporate spending for offshore information technology will increase from $1.8 billion in 2003 to over $26 billion by 2007.[17]

6) Online hackers have successfully penetrated military computers, and critics of NCW are concerned about cyber-attacks. One study has shown that the DoD uses a variety

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[15] It should be noted that the Defense Information Systems Agency (DISA) will soon field a new GCCS version designed to use one database. See Dawn S. Onley, "Franks Credits Technology with Decisive Wins," *Government Computer News*, February 23, 2004, available at: http://www.gcn.com/vol21_no2/daily-updates/13774-1.html.

[16] Matthew French, "Bandwidth in Iraq a Subject of Debate," *Federal Computer Week*, October 20, 2003, available at: http://www.fcw.com/fcw/articles/2003/1020/tec-iraq-10-20-03.asp.

[17] Paul McDougall, "Optimizing Through Outsourcing," *Information Week*, March 1, 2004, available at: http://www.informationweek.com/story/showArticle.jhtml?articleID=18200825.

of open-source computer software programs and concluded that open-source software is critical to DoD security.[18]

RECOMMENDATION

The DoD's Office of Force Transformation (OFT) has stated, "To the degree we do not transform, we are strategically a fixed-target and therefore at risk." It would not be unfair to say that the OFT may be driven by more than one objective and, therefore, not without any predispositions in their statements. Heeding the OFT's warning, Congress has allocated the spending of $401.7 billion for the Pentagon's NCW doctrine in 2005, a 5.7 percent more than the previous year's $380 billion.[19] And certain aspects of research and development of FCS will be 20 percent more than the peak levels of President Ronald Reagan's historic defense buildup.[20] Considering the current budget deficit of the U.S. federal government, the questions and skepticism may be justified. However, in theory and in limited tests, network centric operations improve mission planning, accelerate our own OODA cycle, expand the area of relative superiority resulting from speed, and can ultimately increase combat effectiveness. All of the potential setbacks and vulnerabilities of NCW are currently in the process of being studied and addressed, and many are making significant progress and breakthroughs. NCW has inherent and real advantages over traditional platform-oriented operations. If maintaining the U.S.' military superiority in the twenty-first century where weapons of mass destruction are proliferating to "rogue states" is top priority, then NCW development must continue.

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[18] Dawn S. Onley, "DISA Chief Says DoD's Code Red Defense Worked," *Government Computer News*, August 29, 2001, available at: http://www.gcn.com/vol1_no1/daily-updates/16964-1.html.
[19] Sara Michael, Dibya Sarkar, and Frank Tiboni, "Budget Winners," *Federal Computer Week*, February 9, 2004, available at: http://www.fcw.com/fcw/articles/2004/0209/news-winners-02-09-04.asp.
[20] "Congress Backs Pentagon Budget Heavy on Future Weapons," *Washington Post*.